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Protection Branch Report of Test No. 24-60

INVESTIGATION OF BACTERIAL CONTAMINATION INSIDE ELECTRONIC COMPONENTS. TEST II

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Investigation of Bacterial Contamination Inside Electronic Components. Test II

Various electronic components, received in March 1960 from Jet Propulsion Laboratories, California Institute of Technology, Pasadena, California, were tested for possible internal bacterial contamination.

MATERIALS AND METHODS

Before the electronic components were tested in this laboratory, some of them were subjected to dry heat at the Jet Propulsion Laboratories. The thermionic cores received a special treatment before assembling in that the threads and contacting surfaces were inoculated with Bacillus subtilis var niger spores. After the cores were reassembled, some were subjected to dry heat, others were not.

In each test, several electronic components of the same variety and type, tools needed to break and grind the components, and tryptose broth blanks sealed with tape were placed in a plastic chamber and exposed to ethylene oxide gas for six hours. After aerating the chamber for 16 hours, each electronic component was broken, ground as well as possible, and the pieces put into a broth blank to incubate at 37 C. A detailed description of the above procedure is given in Protection Branch Report of Test No. 19-60 and 7-60.

The test for sterility was expanded over that which was reported earlier. After the broth sample had incubated at 37C for seven days, aliquots of the broth were put into tryptose broth and thioglycollate fluid medium respectively, and incubated at 37C for several days before being checked for bacterial growth. This procedure was adopted to eliminate possible inhibition caused by some materials in some electronic components. The thioglycollate fluid medium was used in addition to tryptose broth in order to detect anaerobic bacteria. An aliquot of the broth sample was also streaked on tryptose agar to check for bacterial growth. Methylene blue stains of the broth samples and the two broth subcultures were examined microscopically for microorganisms and compared with a stain of bacteria from agar if growth occurred. Finally, if no microorganisms grew on agar or if no microorganisms were seen during examination of the methylene blue stain of the broth, the broth sample was inoculated with about 100 Staphylococcus aureus cells from a 24 hour tryptose broth culture, to assure that the broth was capable of supporting growth.

RESULTS AND DISCUSSION

The results given in Tables I and II show that internal bacterial contamination was present in 20 to 25 per cent of the capacitors and resistors tested. Moreover, internal bacterial contamination was present in some electronic components which had been subjected to dry heat at

125 C for 13-1/2 hours. Perhaps the reason it is more difficult to kill microorganisms, by dry heat, in electronic components than in diatomaceous earth (see Protection Branch Report of Test 22-60) is because the oxygen content is probably much less in these components. Apparently, to kill bacteria inside components by dry heat, the temperature or the length of exposure or perhaps both factors will have to be increased.

The only electronic component given in Table III that had internal bacterial contamination was one choke. The assembled thermionic cores, whose threads and contacting surfaces were inoculated with a heavy concentration of Bacillus subtilis var niger spores were not sterilized by ethylene oxide gas in six hours. To assure sterility of such components, it will be necessary to expose the parts to ethylene oxide before assembly or perhaps to use some other sterilizing procedure for the assembled component. No conclusions can be made about the thermionic cores that were heated at 105 C for 24 hours since the presence of the core in broth inhibit growth of S. aureus introduced. It is interesting that the heated core should be inhibitory whereas the non-heated core was not.

TABLE I.

Variety and Number of Capacitors Internally Contaminated

Variety of Capacitor	Manufacturer	Treatment	No. Contaminated / No. Tested
Ceramic disc, LVF, 1000V, MDC 10%	Maida	125C/13½ hrs	2/2
Ceramic disc, LVF, 1000V, MDC 10%	Maida	Not heated	1/2
Feed-thru & Stand-off, 287A, 1200 uuf, AMV	Maida	125C/13½ hrs	0/4
Feed-thru & Stand-off, 287A, 1200 uuf, AMV	Maida	Not heated	2/8
Ceramic disc, Min-N, 0.05, 75V	Glenco	125C/13½ hrs	0/2
Ceramic disc, Min-N, 0.05, 75V	Glenco	Not heated	1/2
Ceramic disc, Min-N, 0.01, 75V	Glenco	Not heated	1/4
Dipped mica, DM-15, 934	Elmenco	125C/13½ hrs	0/2
Dipped mica, DM-15, 934	Elmenco	Not heated	0/2
150D476X003552, tantalum	Sprague	Not heated	0/4

Note: There was no performance degradation of the capacitors that were heated.

Table II.

Variety and Number of Resistors Internally Contaminated

Variety of Resistor	Manufacturer	Treatment	No. Contaminated / No. Tested
CB-1/4, EB-1/2, GB-1	Allen-Bradley	125C/13½ hrs	3/4
CB-1/4, EB-1/2, GB-1	Allen-Bradely	Not heated	0/8
C-170N, 206-10518, 238A	Mepco	125C/13½ hrs	1/2
C-170N, 206-10518, 238A	Mepco	Not heated	0/2

Note: There was no performance degradation of the resistors that were heated.

Table III

Type, Variety and Number of Miscellaneous Electronic Components
Internally Contaminated

Type and Variety of Component	Manufacturer	Treatment	No. Contaminated / No. Tested
Choke: 4.7 uHy	NY Transformer	Not heated	1/2
Transistor: 2N700, germanium	Motorola	Not heated	0/3
Core: SF, T-37-6, carbonyl	Micrometals	Not heated	0/4
Core: TH, T37-7, carbonyl	Micrometals	Not heated	0/4
Core: W T37-10, carbonyl	Micrometals	Not heated	0/4
Core: Thermionic, white iron, LS9-2-2R, mounted on Al panel*	Cambridge	Not heated	3/3
Core: Thermionic, white iron KLS9-2-2R, mounted on Al panel*	Cambridge	105C/24 hours	0/3**

* Threads and contacting surfaces were inoculated with B. subtilis var niger spores.

** Broth did not support growth of S. aureus introduced.